CONTROLLER

Digital Temperature Controller

RS SERIES

CE cULus

Reinforced Insulation

MADE IN JAPAN

RKC INSTRUMENT INC.

Digital Temperature Controller

RS Series

Reinforced Insulation

MADE IN JAPAN

To succeed the popular CH and RH series,
more than a new controller has just come up.
Enhanced visibility and reliability.
Flexible output configuration to increase
freedom of configuration.
High cost effectiveness can be achieved.

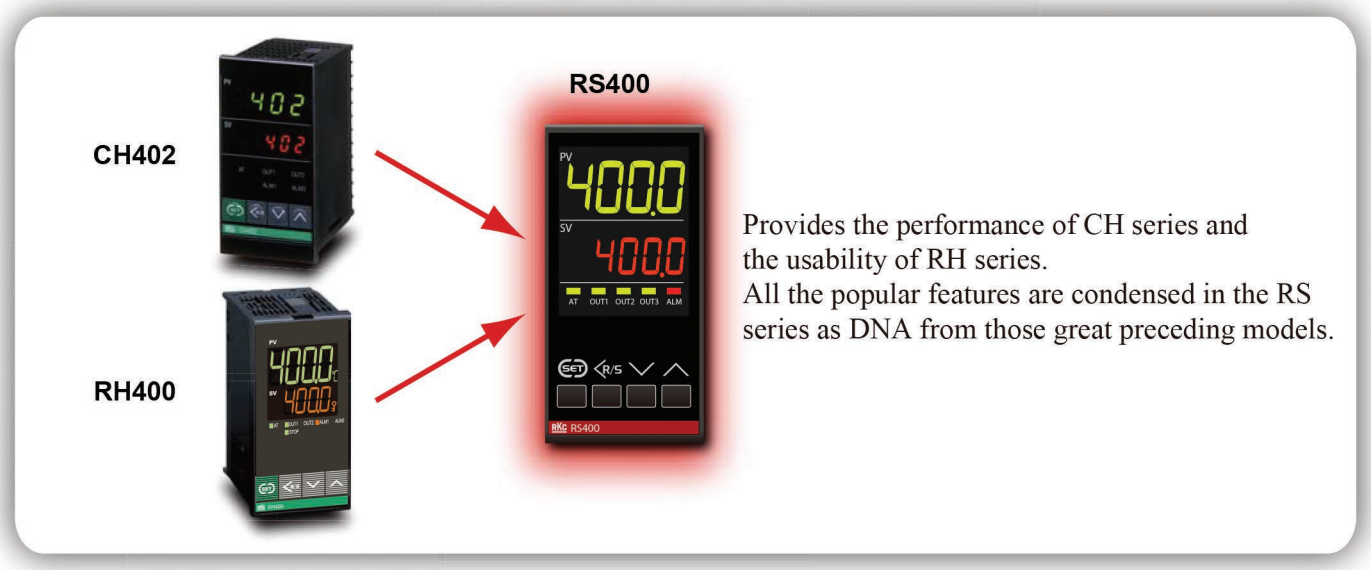
Long Operation Life

High Speed Sampling, High Accuracy

Clear Display
Makes Your Machine Look Sharp

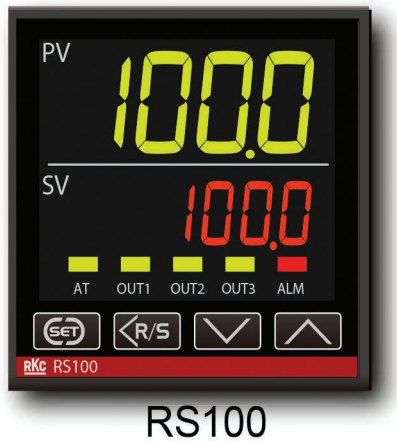
Flexible Output Configuration

Easy Maintenance



Provides the performance of CH series and
the usability of RH series.
All the popular features are condensed in the RS
series as DNA from those great preceding models.

Clear Display
Makes your machine look sharp

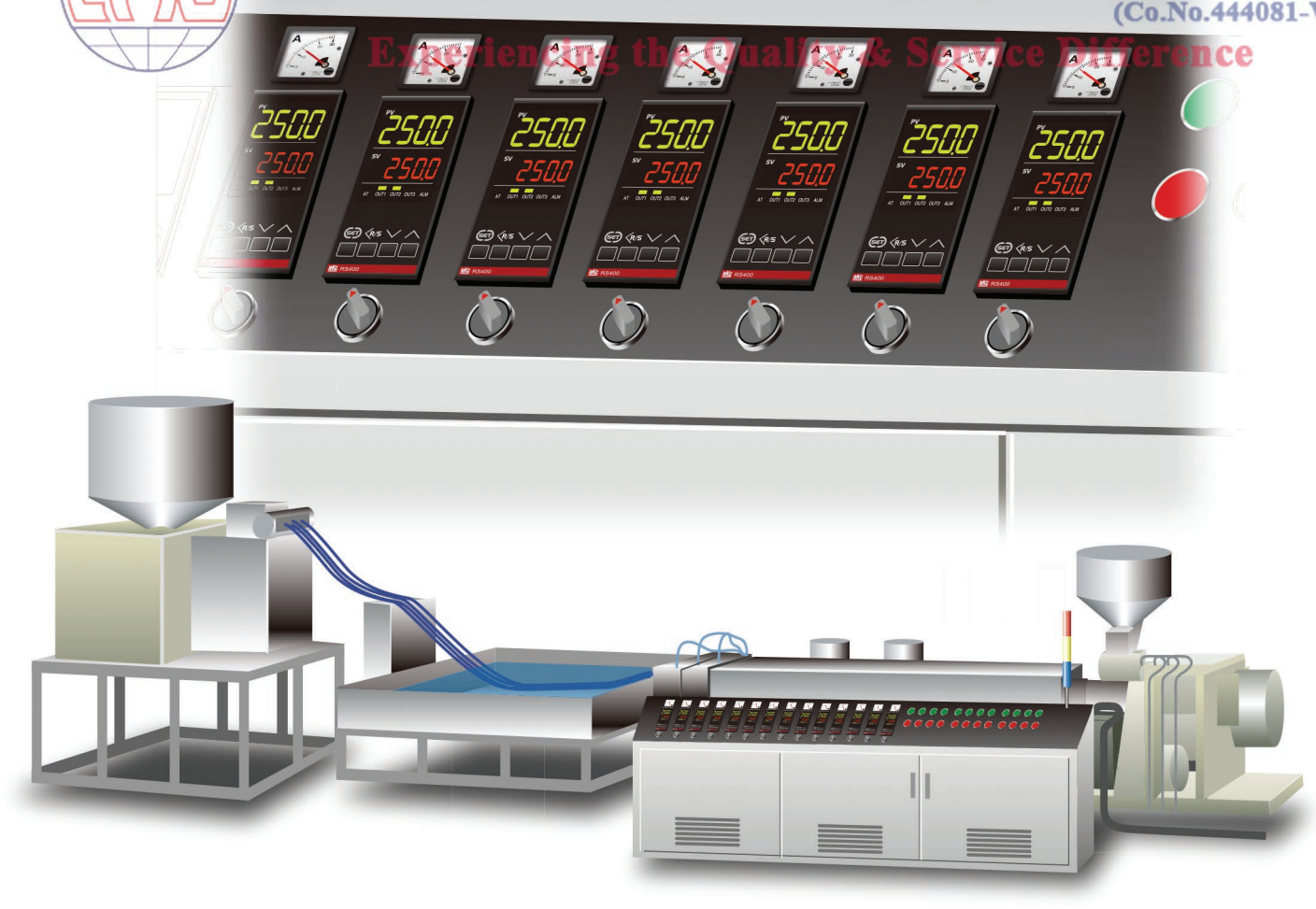


RS100

(Actual Size)

RS400

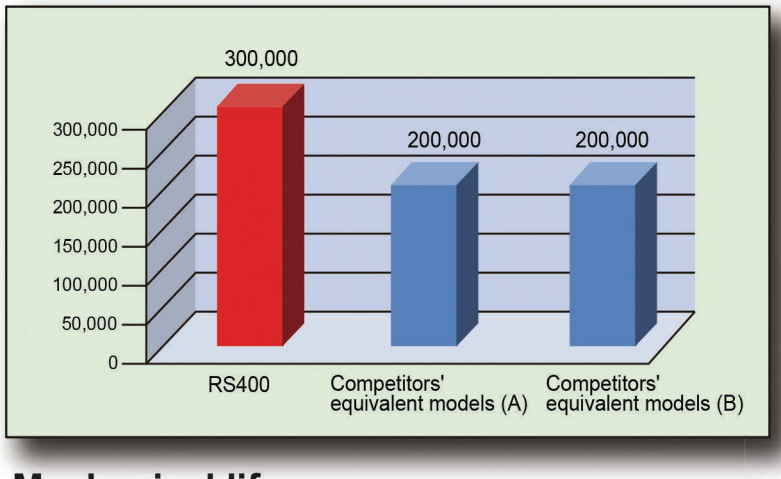
Uses large high intensity LED.
Clear wide view angle provides outstanding visibility.

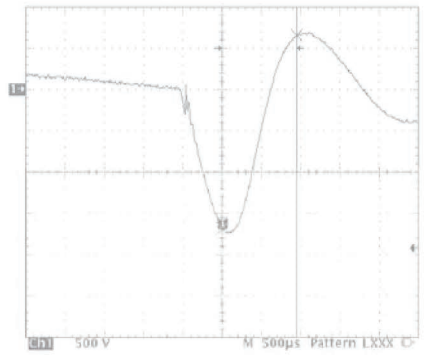


Long Operation Life

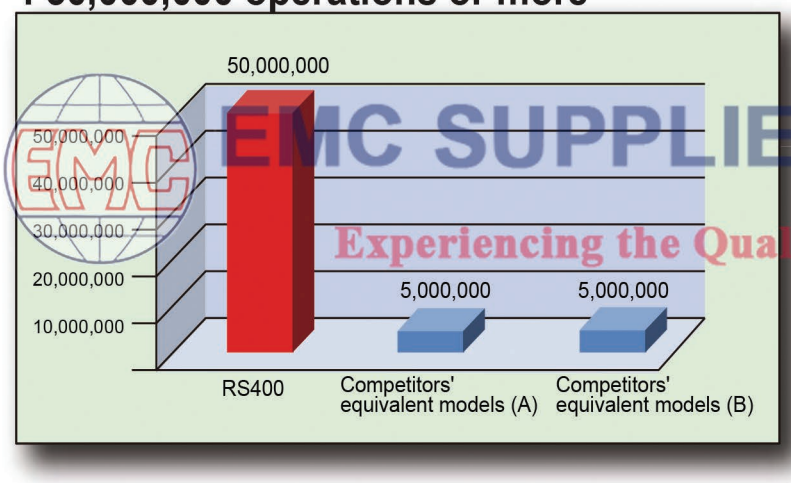
Use of high performance control relay assures long term operation.
Designed to match the specification of the popular magnetic contactors.

Electrical Life
(Relay contact output)
: 300,000 operations or more



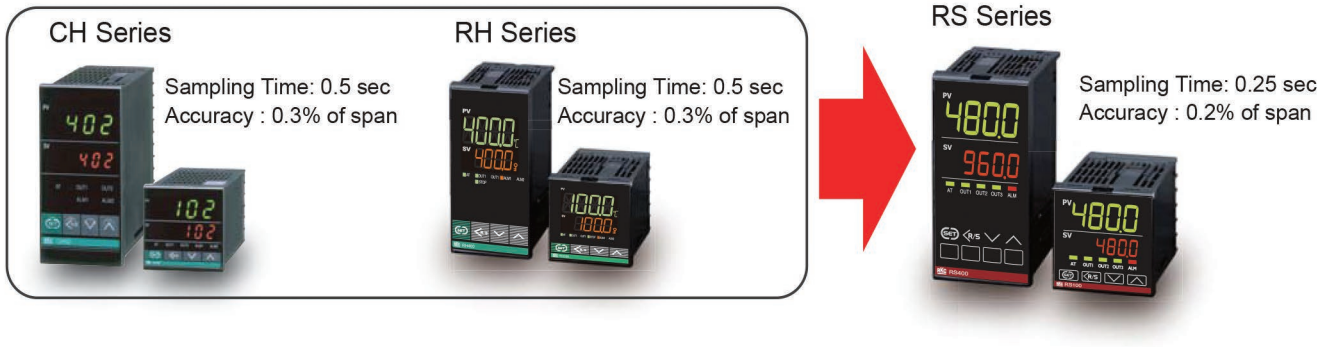


Mechanical life
(Relay contact output)
: 50,000,000 operations or more



· Applies to the control output relays mounted on OUT1 and OUT2 of RS400.
· Data when used at a rated value
Depending on the operating conditions, there may be some exceptions that we cannot guarantee.

High Speed Sampling, High Accuracy



Flexible Output Configuration

This controller can incorporate up to 2 of relay output, voltage pulse output, or current output as OUT1 and OUT2, and 1 relay output as OUT3.
Each of these outputs can be configured to control output (heat or cool), alarm output (alarm 1 or 2), and HBA output (HBA1 or 2).
Output type is freely changeable to meet the requirements of different applications.

Heat-side Control Output
Cool-side Control Output
Alarm 1 Output
Alarm 2 Output
HBA 1 Output
HBA 2 Output

→ OUT1
Output 1 (OUT1) : Relay contact, Voltage pulse, DC current
Output 1 (OUT1) Assignment
: Heat-side Control Output, Cool-side Control Output
Alarm 1/Alarm 2 Output, HBA1/HBA2 Output

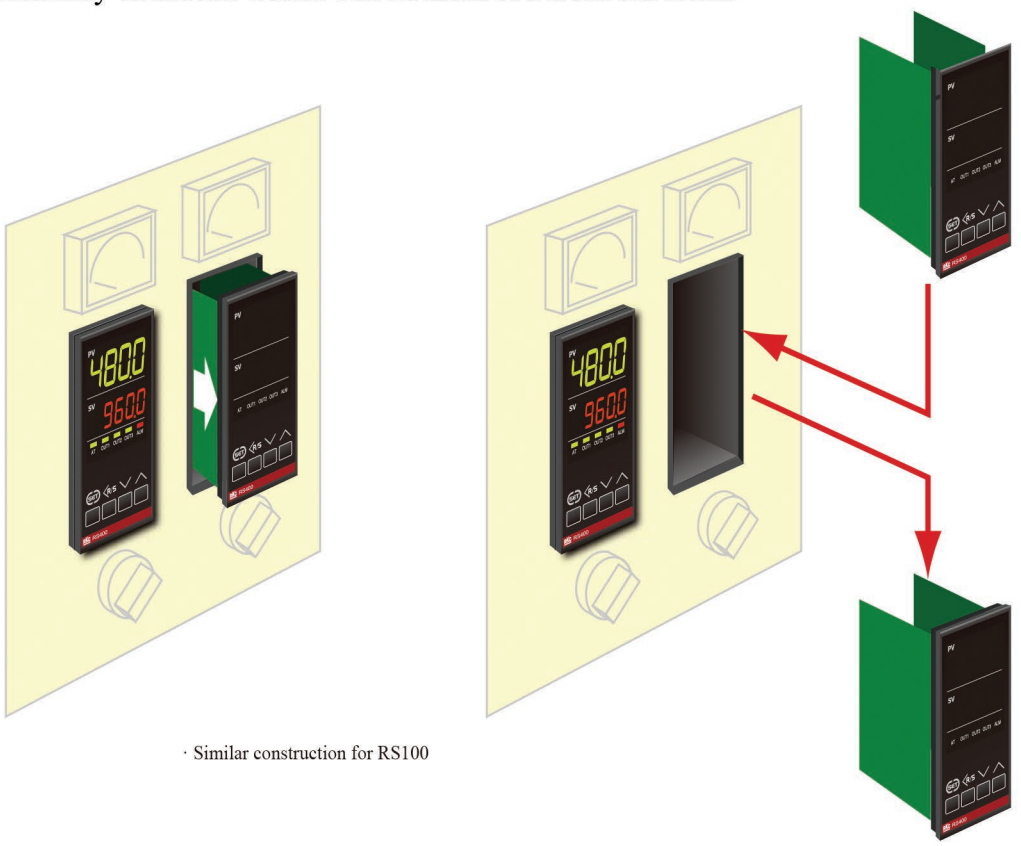
→ OUT2
Output 2 (OUT2) : Relay contact, Voltage pulse, DC current
Output 2 (OUT2) Assignment
: Heat-side Control Output, Cool-side Control Output
Alarm 1/Alarm 2 Output, HBA1/HBA2 Output

→ OUT3
Output 3 (OUT3) : Relay contact
Output 3 (OUT3) Assignment
: Cool-side Control Output
Alarm 1/Alarm 2 Output, HBA1/HBA2 Output

· Please specify the output type (relay, voltage pulse or current) at the time of ordering.

Easy Maintenance

The internal assembly of the RS Series can be removed from the front.



· Similar construction for RS100

Main Specifications

Temperature Input

Input type	Thermocouple K, J, T, E, S, R, B, N (JIS/IEC) PLII (NBS), W5Re/W26Re (ASTM), U, L (DIN) RTD Pt100 (JIS/IEC), JPt100 (JIS) • 3-wire system • Universal inputs.
Sampling time	0.25sec
Influence of external resistance	0.2μV/Ω (Thermocouple input)
Influence of lead resistance	0.02% of reading/Ω (RTD input) • Maximum 10Ω per wire
Input break action	Thermocouple input : Up-scale RTD input : Up-scale
Input short action	Down-scale (RTD input)
PV bias	-1999(-199.9) to +9999(999.9)°C(°F)
Input digital filter	1 to 100 sec. (OFF when 0 is set.)

Current transformer (CT) input (Optional)

Number of alarms	Up to 2 points
CT Type and input range	CTL-6-P-N : 0 to 30A CTL-12-S56-10L-N : 0 to 100A
Sampling time	0.5sec

Output

Number of outputs	Up to 3 points (OUT1 to OUT3)
Output function	Control output, Alarm output, HBA (Heater break alarm) output
Output type	Relay contact output (1) [OUT1,2 of RS400 : Control output] a) Contact type : 1a contact b) Contact rated : 250V AC 3A, 30V DC 1A (Resistive load) c) Electric life : 300,000 operations or more (Rated load) d) Mechanical life : 50,000,000 operations or more Relay contact output (2) [OUT1,2 and 3 of RS100 : Control output, OUT3 of RS400 : Control output] a) Contact type : 1a contact b) Contact rated : 250V AC 3A, 30V DC 1A (Resistive load) c) Electric life : 100,000 operations or more (Rated load) d) Mechanical life : 20,000,000 operations or more Relay contact output (3) [RS100 and RS400 : Alarm output, HBA output a) Contact type : 1a contact b) Contact rated : 250V AC 1A, 30V DC 0.5A (Resistive load) c) Electric life : 150,000 operations or more (Rated load) d) Mechanical life : 20,000,000 operations or more Voltage pulse output : 0/12V DC (Load resistance : More than 500Ω) Current output: 4 to 20mA DC, 0 to 20mA DC (Load resistance : Less than 500Ω)

Performance

Measuring accuracy

Input Type	Range	Accuracy
K, J, T, E, PLII *1 U, L	Lower than -100°C (-148°F) -100 to 500°C (-148 to 932°F) 500°C (932°F) or higher	± (2.0°C [3.6°F] + 1 digit) ± (1.0°C [1.8°F] + 1 digit) ± (0.2% of Reading + 1 digit)
N, R, S *2 W5Re/W26Re	Lower than 0°C (32°F) 0 to 1000°C (32 to 1832°F) 1000°C (1832°F) or higher	± (4.0°C [7.2°F] + 1 digit) ± (2.0°C [3.6°F] + 1 digit) ± (0.2% of Reading + 1 digit)
B	Lower than 400°C (752°F) 400°C (752°F) or higher	± (70°C [126°F]) + 1 digit) ± (2°C [3.6°F] + 1 digit)
Pt100, JPt100	Lower than 200°C (392°F) 200°C (392°F) or higher	± (0.4°C [0.7°F] + 1 digit) ± (0.2% of Reading + 1 digit)

*1 : Accuracy is not guaranteed for less than -100°C .
*2 : Accuracy is not guaranteed for less than 400°C (752°F) for Input Type R, S, B and W5Re/W26Re.

Cold junction temperature compensation error	±0.5°C (-10 to +55°C (14 to 131°F))
CT input accuracy	±5% of input value or 2A (whichever is larger)
Influence of ambient temperature	Temperature input : ±0.06°C/°C Current output : ±0.02% of span/°C

Alarm (Optional)

Number of alarms	Up to 2 points
Alarm type	Process high, Process low, Deviation high, Deviation low, Deviation high/low*1, Band, Set value high, Set value low, LBA (Control loop break alarm), RUN status monitor *1: Two types of alarm settings are field-selectable. 1. Independent high and low settings. 2. Common high/low setting (Factory setting, unless specified in alarm code when ordering)
Other functions	a) Hold/Re-hold action • Hold action is activated at power-on and stop-to-run. Re-hold action is activated at power-on, stop-to-run, and the control set value change. b) Energized/de-energized action is configurable. c) Action at over-scale/under-scale d) Differential gap : 0 (0.0) to 100.0°C(°F) e) Delay timer : 0 to 600 sec f) Interlock (latch) function is configurable.
Loop break alarm (LBA)	LBA time : 0.1 to 200.0 min LBA deadband : 0 to 9999(999.9)°C(°F)

Heater break alarm (Optional)

Number of alarms	2 points (1 point per CT input)
Setting range	0.0 to 100.0A • OFF when 0 is set. CT monitor is available.
Delay times	0 to 255 sec
Other functions	Interlock (latch) function is configurable.

Control

Control method	PID control (With autotuning) • P, PI, PD, ON/OFF control selectable • Direct action/Reverse action is selectable Heat/Cool type PID control (With autotuning)
Setting range	a) Proportional band : 1(0.1) to span (°C,°F) • Within 9999(999.9)°C (°F) (ON/OFF control when P = 0) • Differential gap at ON/OFF control (High/Low individual setting) : 0(0.0) to 9999 (999.9) (°C,°F) b) Integral time : 1 to 3600 sec (PD control when I = 0) c) Derivative time : 1 to 3600 sec (PI control when D = 0) d) Cool side proportional band : 1 to 1000% of heat side proportional band * Invalidity when P=0. * Only cooling side ON/OFF control is not available. e) Anti-Reset Windup(ARW) : 1 to 100% of heat side proportional band (Integral action is OFF when ARW = 0) f) Deadband/Overlap : -10 (-10.0) to 10 (10.0) °C (°F) • Minus setting : Overlap h) Output limiter PID control : -5.0 to +105.0% (High/Low individual setting) Heat/Cool type PID control : 0.0 to 105.0% (Only limiter high) (Heat side/Cool side individual setting) g) Proportional cycle time : 1 to 100 sec
Additional function	Fine tuning, Startup tuning, Auto tuning, RUN/STOP

Communication (Optional)

Communication method	RS-485
Protocol	a) ANSI X3.28 sub-category 2.5A4 (RKC standard) b) MODBUS-RTU
Communication speed	2400bps, 4800bps, 9600bps, 19200bps, 38400bps
Bit format	a) RKC standard protocol Start bit : 1 Data bit : 7 or 8 Parity bit : 1 (odd or even) or none Stop bit : 1 or 2 b) MODBUS protocol Start bit : 1 Data bit : 8 Parity bit : 1 (odd or even) or none Stop bit : 1 or 2
Maximum connection	31 units

General Specifications

Supply voltage	85 to 264V AC (50/60Hz common) Rating : 100 to 240V AC
Rush current	Less than 5.6A (100V), Less than 13.3A (240V)
Power consumption	RS100 : 5.1VA (100V), 7.6VA (240V), RS400 : 5.9VA (100V), 8.4VA (240V)
Insulation resistance	More than 20MΩ (500V DC) between measured terminals and ground
Dielectric voltage	2300V AC for 1 minute
Power failure	A power failure of 20msec or less will not affect the control action.
Ambient temperature	-10 to 55°C (14 to 131°F)
Ambient humidity	5 to 95%RH (Non condensing) • Absolute humidity : MAX.W.C29.3g/m3 dry air at 101.3kPa
Weight	RS100 : 115g, RS400 : 165g
Compliance with standards	UL : UL61010-1 cUL : CAN/CSA-22.2 NO.61010-1 CE : LVD : EN61010-1 OVERVOLTAGE CATEGORYII, POLLUTION DEGREE 2, Class II (Reinforced insulation) EMC: EN61000-3-2, EN61326-1 C-Tick : AS/NZS CISPR 11 (equivalent to EN55011)

Model and Suffix Codes

Specifications				①	②	③	④	⑤	⑥	⑦	⑧	⑨
		48×48mm (1/16 DIN) **RS100** / 48×96mm (1/8 DIN) **RS400**		–	□	□	□	*	□	□	N /	□	–	□	□	□
①	Output 1 (OUT1)	Not supplied	N									
		Relay contact output	M									
		Voltage pulse output	V									
		0 to 20mA DC	7									
		4 to 20mA DC	8									
②	Output 2 (OUT2)	Not supplied		N								
		Relay contact output		M								
		Voltage pulse output		V								
		0 to 20mA DC		7								
		4 to 20mA DC		8								
③	Output 3 (OUT3)	Not supplied			N							
		Relay contact output			M							
④	CT input	Not supplied				N						
		For CTL-6-P-N (0 to 30A) 2 points				T						
		For CTL-12-S56-10L-N (0 to 100A) 2 points				U						
⑤	Communication	Not supplied					N					
		RS-485 (ANSI/RKC standard protocol)					5					
		RS-485 (MODBUS protocol)					6					
⑥	Waterproof/Dustproof	Not supplied						N				
⑦	Initial Setting (Quick start code)	No Quick Start Code 1 and 2 (Default setting) *1							N			
		Specify Quick Start Code 1 *2							1			
		Specify Quick Start Code 1 and 2							2			
Quick Start Code 1	⑧ Control Method	PID control with AT (Reverse action)									F	
		PID control with AT (Direct action)									D	
		Heat/Cool PID control with AT									G	
		Heat/Cool PID control with AT for extruder (Air cooling type)									A	
		Heat/Cool PID control with AT for extruder (Water cooling type)									W	
	⑨ Input and Range	See the Input Range Code										□□□

*1 : Default setting (No Quick Start Code 1)

Specification \ Output type	OUT1 supplied OUT2 not supplied	OUT1 supplied OUT2 supplied
Control Method	PID control with AT (Reverse action)	Heat/Cool PID control with AT for extruder (Air cooling type)
Input Range	Thermocouple K, 0 to 400℃	

• OUT3 : Deviation high alarm.

*2 : Default setting (No Quick Start Code 2)

• PID control with AT (Code:F/D) type

Output	OUT1	Supplied	Supplied	Supplied	Supplied
	OUT2	Not supplied	Supplied	Not supplied	Supplied
	OUT3	Not supplied	Not supplied	Supplied	Supplied
Output assigment	OUT1	Control output (Reverse action)	Control output (Reverse action)	Control output (Reverse action)	Control output (Reverse action)
	OUT2	Not supplied	Alarm1 output (deviation high)	Not supplied	Alarm1 output (deviation high)
	OUT3	Not supplied	Not supplied	Alarm1 output (deviation high)	Alarm2 output (deviation low)

• Heat/Cool PID control with AT (Code:G/A/W) type

Output	OUT1	Supplied	Supplied
	OUT2	Supplied	Supplied
	OUT3	Not supplied	Supplied
Output assigment	OUT1	Control output (Heat control)	Control output (Heat control)
	OUT2	Control output (Cool control)	Control output (Cool control)
	OUT3	Not supplied	Alarm1 output (deviation high)

Quick Start Codes 2

• Quick start code tells the factory to ship with each parameter preset to the values detailed as specified by the customer.
Quick start code is not necessarily specified when ordering, unless the preset is requested.
These parameters are software selectable items and can be re-programmed in the field via the manual.

Specifications		(1)	(2)	(3)	(4)	(5)	(6)	(7)
		□	□ – □	– □	– □	□ –	□	□
(1) Alarm1 Type / (2) Alarm2 Type	None	N	N					
	Deviation High	A	A					
	Deviation Low	B	B					
	Deviation High/Low (Common high/low setting)	C	C					
	Band (Common high/low setting)	D	D					
	Deviation High with Hold	E	E					
	Deviation Low with Hold	F	F					
	Deviation High/Low with Hold (Common high/low setting)	G	G					
	Process High	H	H					
	Process Low	J	J					
	Process High with Hold	K	K					
	Process Low with Hold	L	L					
	Deviation High with Alarm Re-hold	Q	Q					
	Deviation Low with Alarm Re-hold	R	R					
	Deviation High/Low with Re-Hold (Common high/low setting)	T	T					
	Band (Individual high and low settings)	U	U					
	Set value High	V	V					
	Set value Low	W	W					
	Deviation High/Low (Individual high and low settings)	X	X					
	Deviation High/Low with Alarm Hold (Individual high and low settings)	Y	Y					
	Deviation High/Low with Alarm Re-Hold (Individual high and low settings)	Z	Z					
	Loop break alarm	Can not be specified	2					
	RUN status	4	4					
(3) Control Output Assignment	a) PID control type : Output 1 (OUT1) b) Heat/Cool PID control : Heat-side output : Output 1 (OUT1) Cool-side output : Output 2 (OUT2)			1				
	a) PID control type : Output 2 (OUT2) b) Heat/Cool PID control : Heat-side output : Output 2 (OUT2) Cool-side output : Output 1 (OUT1)			2				
(4) Alarm1 Output Assignment *1	No assignment				N			
	Output 1 (OUT1)				1			
	Output 2 (OUT2)				2			
	Output 3 (OUT3)				3			
(5) Alarm2 Output Assignment *1	No assignment					N		
	Output 1 (OUT1)					1		
	Output 2 (OUT2)					2		
	Output 3 (OUT3)					3		
(6) HBA1 Output Assignment *2	No assignment						N	
	Output 1 (OUT1)						1	
	Output 2 (OUT2)						2	
	Output 3 (OUT3)						3	
(7) HBA2 Output Assignment *2	No assignment							N
	Output 1 (OUT1)							1
	Output 2 (OUT2)							2
	Output 3 (OUT3)							3

*1 : Cannot be specified if the output terminal is already specified for control output.
*2 : Cannot be specified if the output terminal is already specified for control output.

Example of Model Codes and Quick Start Codes

Specifications

Input/Range : Thermocouple K 0 to 400℃
Control Method : Heat/Cool PID control (Water Cooling)
Heat-side Output : Output 1 (OUT1)
Cool-side Output : Output 2 (OUT2)
Alarm 1 : Deviation High (Output 3(OUT3))
Alarm 2 : Deviatio Low with Alarm Hold (Output 3(OUT3))
• OUT3 : OR logic output of Alarm 1 and Alarm 2

Factory Setting Codes

Model and Suffix Codes /N2 -WK02

Control Method	Heat/Cool PID Control (Water Cooling)	Code : W
Input/Range	Thermocouple K 0 to 400℃	Code : K02

Quick Start Codes

AF-1-33-NN

Alarm1	Deviation High	(1) Code : A
Alarm2	Deviatio Low with Alarm Hold	(2) Code : F
OUT1	Heat-side Control Output	(3) Code : 1
OUT2	Cool-side Control Output	
OUT3	Alarm 1 and Alarm 2	(4) Code : 3
		(5) Code : 3
HBA	None	(6) Code : N
		(7) Code : N

Input Range Codes

Input		Range	Code
Thermocouple	K (JIS/IEC)	0 to 200℃	K 01
		0 to 400℃	K 02
		0 to 600℃	K 03
		0 to 800℃	K 04
		0 to 1000℃	K 05
		0 to 1200℃	K 06
		0 to 1372℃	K 07
		0.0 to 400.0℃	K 09
		0.0 to 800.0℃	K 10
		0 to 100℃	K 13
		0 to 300℃	K 14
		0 to 450℃	K 17
		0 to 500℃	K 20
		-200 to +1372℃	K 41
		-199.9 to +400.0℃	K 43
		0 to 800°F	K A1
		0 to 1600°F	K A2
		0 to 2502°F	K A3
		-100.0 to +752.0°F	K C8
	J (JIS/IEC)	0 to 200℃	J 01
		0 to 400℃	J 02
		0 to 600℃	J 03
		0 to 800℃	J 04
		0 to 1000℃	J 05
		0 to 1200℃	J 06
		-199.9 to +300.0℃	J 07
		0 to 450℃	J 10
		0 to 800°F	J A1
		0 to 1600°F	J A2
		0 to 2192°F	J A3
		0 to 300°F	J A6
		0 to 800°F	J A7
		-328 to +2192°F	J B9
		-199.9 to +550.0°F	J C8

Input		Range	Code
Thermocouple	T (JIS/IEC)	-199.9 to +400.0℃	T 01
		-199.9 to +100.0℃	T 02
		-100.0 to +200.0℃	T 03
		0.0 to 350.0℃	T 04
		-199.9 to +300.0℃	T 05
		0.0 to 400.0℃	T 06
	R (JIS/IEC)	0 to 1600℃	R 01
		0 to 1769℃	R 02
		0 to 1350℃	R 04
		0 to 3200°F	R A1
	S (JIS/IEC)	0 to 1600℃	S 01
		0 to 1769℃	S 02
	B (JIS/IEC)	400 to 1800℃	B 01
		0 to 1820℃	B 02
	E (JIS/IEC)	0 to 800℃	E 01
		0 to 1000℃	E 02
	N (JIS/IEC)	0 to 1200℃	N 01
	W5Re/W26Re (ASTM)	0 to 2000℃	W01
		0 to 2320℃	W02
		0 to 4000°F	WA1
	PLII (NBS)	0 to 1300℃	A 01
		0 to 1390℃	A 02
		0 to 1200℃	A 03
		0 to 2400°F	A A1
		0 to 2534°F	A A2
	U (DIN)	-199.9 to +600.0℃	U 01
	L (DIN)	0 to 400℃	L 01

Input		Range	Code
RTD	Pt100 (JIS/IEC)	-199.9 to +649.0℃	D 01
		-199.9 to +200.0℃	D 02
		-100.0 to +50.0℃	D 03
		-100.0 to +100.0℃	D 04
		-100.0 to +200.0℃	D 05
		0.0 to 50.0℃	D 06
		0.0 to 100.0℃	D 07
		0.0 to 200.0℃	D 08
		0.0 to 300.0℃	D 09
		0.0 to 500.0℃	D 10
		-199.9 to +999.9°F	D A1
		-199.9 to +200.0°F	D A3
		-199.9 to +100.0°F	D A4
		-199.9 to +300.0°F	D A5
		0.0 to 100.0°F	D A6
		0.0 to 400.0°F	D A8
		0.0 to 500.0°F	D A9
		-199.9 to +900.0°F	D B2

Input		Range	Code
RTD	JPt100 (JIS)	-199.9 to +649.0℃	P 01
		-199.9 to +200.0℃	P 02
		-199.9 to +100.0℃	P 04
		-100.0 to +200.0℃	P 05
		0.0 to 50.0℃	P 06
		0.0 to 100.0℃	P 07
		0.0 to 200.0℃	P 08
		0.0 to 300.0℃	P 09
		0.0 to 500.0℃	P 10